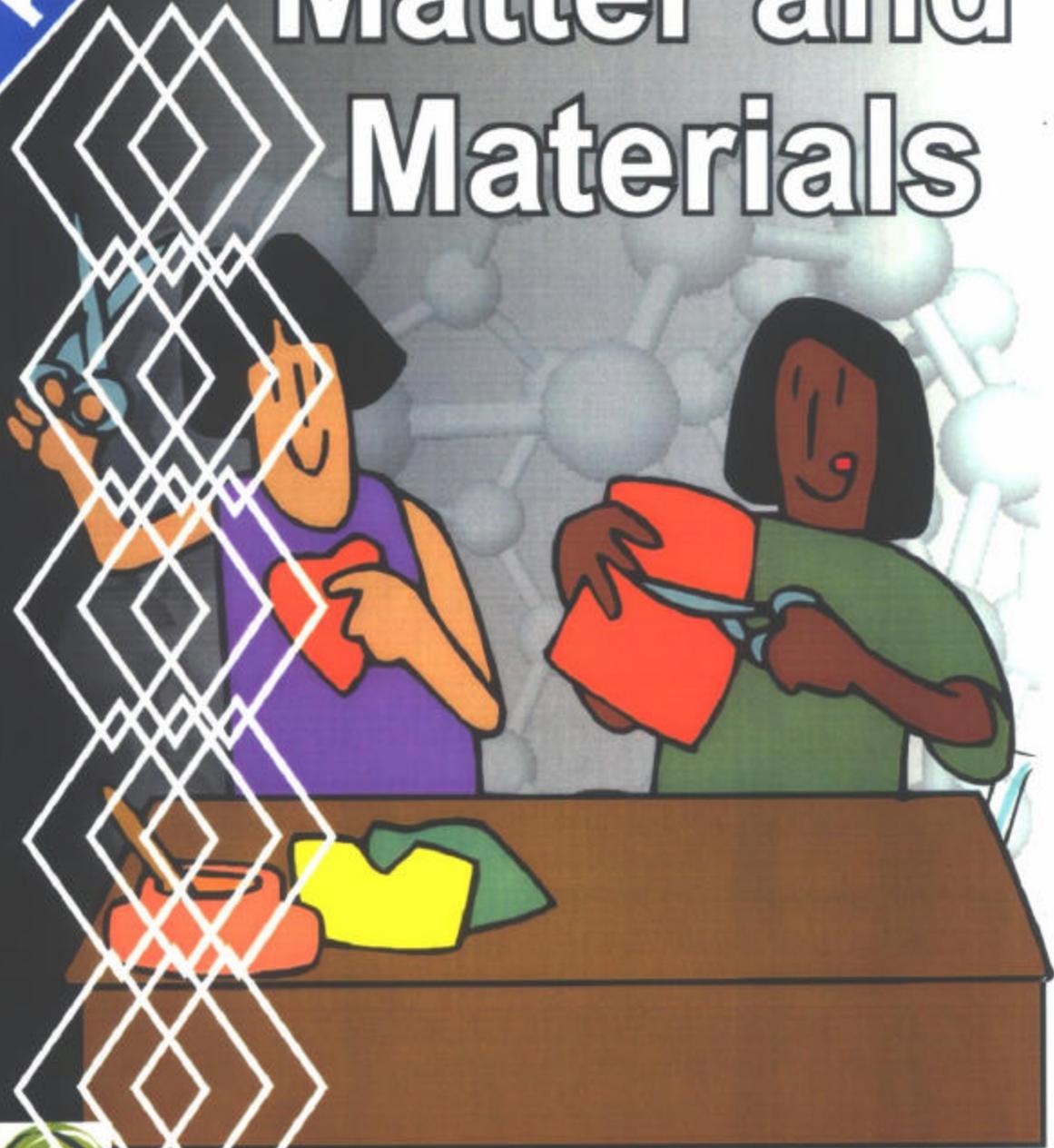


K-6

Primary Science and Technology

Matter and Materials



Teachers' Guide

Matter and Materials

MODULE 1: K – 2

MODULE 2: 3– 4

MODULE 3: 5– 6

Preface

The development of learning outcomes for the core curriculum in OECS primary and lower secondary schools is an essential part of the harmonization of OECS educational systems. The curriculum harmonization process commenced seven years ago with discussions between the OECS Education Reform Unit (OERU) and educational personnel in all member countries (See *Eastern Caribbean Education Reform Project: Initiative on curriculum and remediation – Design Mission report, February 1998*).

The initiative in Primary Secondary Science and Technology commenced in 2001, with a meeting of science and technology educators in St. Vincent and the Grenadines. Time was spent initially on defining science and technology, mainly because the primary curriculum concentrated on science only. A working definition has been developed and has been used consistently throughout the development of the programme.

Draft learning outcomes were developed and circulated for comments throughout the curriculum units in the OECS. Subsequent meetings of the working group were held in St. Kitts and Nevis, St. Lucia and Antigua and Barbuda. At each of these meetings teacher educators, teachers and principals formed part of the discussion groups. After the learning outcomes were adopted by the curriculum officers, instructional modules to serve as teachers' guides were planned and developed by members of the working groups. The learning outcomes and modules were all reviewed and edited by the two consultants who worked through all phases of the project.

Time did not permit a formal piloting of the learning outcomes and modules. Since in most cases the same curriculum officer worked on the lower secondary curriculum, also, there is the possibility of the primary curriculum benefiting from the experience gained in the piloting of the lower secondary programme.

The purpose of developing the learning outcomes and teachers' guide is to ensure that all children in OECS primary schools attain an acceptable level of knowledge, skills and attitudes associated with science and technology. Each member country retains the right and responsibility for integrating these outcomes into the national primary science and technology curriculum. As usual teachers will continue to use their initiative and resourcefulness in the implementation of the programme through the use of indigenous resources creating relevance.

The OERU is extremely grateful for the contribution made by all persons and institutions that have been involved in this developmental exercise. First, OERU expresses thanks to the Canadian International Development Agency (CIDA) for the high level of interest shown and the funding provided for the Eastern Caribbean Education Reform Project (ECERP). The Ministries and Departments of Education have contributed resource personnel, accommodation, refreshment, ground transportation, and some materials for workshops. Most important, however, have been the high level of cooperation and commitment to the reform effort displayed by both the administrative and professional sections of Ministries of Education.

The following science education professionals have made significant contribution over the four-year period.

Country	Participant	Designation
Anguilla	Mr. Worrell Brooks Webster	Education Officer, Science
Antigua and Barbuda	Mr. Earl Skerritt	Science Coordinator
	Ms. Kendra Thomas	Primary school teacher
	Ms. Celia Frederick	Secondary school teacher
	Ms. Gracelyn Ireland	Primary school teacher
British Virgin Islands	Ms. Beverlie Brathwaite	Education Officer, Science
Dominica	Mr. Frank Newton	Education Officer Science
	Mr. Gerald Corbette	Lecturer, Dominica State College
Grenada	Mr. Jervis Viechweg	Curriculum Officer, Science
	Ms. Janis Henry	Lecturer, T. A. Marryshow Com. College
Montserrat	Mr. Gregory Julius	Primary school Principal
St. Kitts	Mr. Hilton Clarke	Curriculum

And Nevis	Dr. Lincoln Carty	Officer, Science Former Curriculum Officer, Science Curriculum
St. Lucia	Mr. Winston Blanchard	Officer, Science Curriculum
	Ms. Imelda Polius	Former Primary school teacher
St. Vincent and the Grenadines	Mrs. Arlette Keane-Browne	Former Curriculum Officer, Science Curriculum
	Mrs. Amaala Muhammad	Officer, Science
	Mr. Kenroy Johnson	Principal, Secondary School

The OERU also expresses gratitude to the dozens of teachers, principals and students who have participated in discussions and consultations.

The actual planning and subsequent developmental process for the learning outcomes and Teachers' Guide became the responsibility of Dr. Cheryl Remy, former Senior Lecturer at Sir Arthur Lewis Community College, St. Lucia and Professor Winston King, Senior Lecturer, School of Education, UWI, to whom the OERU is very grateful. As a team, Dr. Remy and Professor King have encouraged workshop participants and module writers to think and to create ideas as the work progressed.

The staff at OERU together contributed in no small measure to these modules. Ms. Deborah Alphonse, Accounts/Administrative Assistant, Ms. Natasha Deterville, now Secretary to the Director of Economic Affairs in the OECS, and Ms. Cleotha Randolph, Documentation Officer, worked tirelessly arranging workshops and reproducing materials. Ms. Natalie Compton of Nagio Creations competently designed the layout of the guides and learning outcomes for printing and electronic reproduction.

Dr. Henry Hinds, then Curriculum Specialist at OERU, was responsible for the curriculum project. Mrs. Lorna Callender and Ms. Candia Alleyne, both former Heads of OERU, have supported the project organizationally and morally. Mr. Johnson Cenac, ECERP Officer, made significant contributions in various ways and at various times throughout the development of this work.

The Primary Science and Technology modules provide an excellent example of the fusion of talent, creativity, rigorous science and technology and cooperation to develop a valuable resource for teachers.

The OERU hopes that principals and teachers will continue to play their roles in making the outcomes and modules come to life in classrooms throughout the OECS. The commitment and effort surely will contribute to the enhancement of knowledge, and skills and the development of positive attitudes towards science and technology.

Henry Hinds, Head, OERU

August, 2006

Matter and Materials

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RATIONALE

It is sometimes said that we live in a world of “plastics”, suggesting that a large majority of the objects with which we interact in our everyday life is made from plastics. “Plastics” is but one group of the many materials that humans develop and use for a wide variety of technological purposes. Hence the study of materials and their properties provides an avenue for children to better understand the world in which they live and to discover how humans adapt what is in their environment to meet their needs.

The students will also understand why certain materials are more often used than others in the making of the commonly used household items. Students, particularly at the primary level, are very curious and eager to learn. This module which deals with materials and their properties does allow for numerous activities with low cost material since the cost factor in preparing activity based science lessons can be problematic and does affect the nature of the instruction.

It is hoped that teachers will find this module very interesting and packed with hands-on activities, which is the way forward for Science and Technology teaching and learning.

INTRODUCTION

Children at all ages are exposed to materials which exist in the various states of matter. However, we do not always appreciate the importance that these materials play in our daily lives.

These modules aim to raise the awareness of children of the importance of these materials to their daily lives. In the early grades students will be introduced to the sorting of materials based on properties such as size,

shape, hardness or softness, and relate these properties to the everyday usage of these materials.

In the later grades students will be exposed to other properties of materials such as ability to conduct electricity, heat and the magnetic properties of some metals, e.g. iron They will also investigate ways in which materials may be changed.

Processes such as freezing, cooling, heating, melting, condensation and evaporation which are involved in the inter-conversion of the states of matter will also be introduced.

A number of hands-on activities is also designed to enhance some of the process skills, while at the same time give a clear understanding of materials and their properties.

THE EXPERIENCES IN THESE MODULES ALL HELP THE STUDENTS TO DEVELOP THE FOLLOWING MAJOR IDEAS:

MATTER AND MATERIALS

- Matter exists in different forms such as solids, liquids and gases.
- Matter can undergo changes both in its form and composition.
- Matter has properties (such as volume, weight and mass) that can be measured.
- Matter can also be grouped as materials from which objects are made, such as metals, plastics, and glass.
- These materials have different properties which determine their use.
- The properties of materials can be changed and this extends their use.

TECHNOLOGY

- Technological methods involves the use of problem solving, technological processes and resources to find solutions to people's wants and needs.
- Technology is a human activity.
- Individuals can take part in Technological activity.
- Technology involves the uses of materials, energy, tools/machines and information.
- Technology processes include Biotechnology, Production Technology and Transportation .
- Technology changes over time.
- Technology is neither good nor bad, but the way we use it can have positive or negative effects on our lives.
- The use of technology has side effects.

SCIENCE TECHNOLOGY, SOCIETY AND THE ENVIRONMENT

- Science and Technology affect human life, the society and the environment.
- The impact of Science and Technology can be positive and negative, unplanned or planned, immediate or delayed.
- There should be sustainable use of resources and efforts should be made to minimize ecological disturbances.
- People's values, beliefs and attitudes influence scientific and technological activity and use.

MODULE 1

Matter and materials

Grades k - 2

GENERAL OBJECTIVES

The students should be able to:

1. Become aware of materials in their environment and their properties.
2. Become aware that people choose materials to make objects according to their properties.

SPECIFIC OBJECTIVES

The students should be able to:

1. Identify and describe objects according to properties such as colour, size, shape and texture.
2. Classify objects according to properties above.
3. Distinguish between objects and the materials from which they are made.
4. Identify different materials such as wood, glass, clay, plastic, rubber, metal.
5. List objects made from the materials in 4. above.
6. Investigate the properties of materials (e.g. transparency, hardness, strength).
7. Match the properties of materials to their use.
8. Choose materials suitable for making kites, windmills, water wheels, pot holders.
9. Construct a simple object (as in 8) using chosen materials.
10. Recognize that water can be solid or liquid.
11. Describe the properties of solids and liquids using their senses.
12. Give examples of solids and liquids.
13. Compare the properties of liquids used in the home.
14. State that water can change from solid to liquid and from liquid to solid.
15. Identify the conditions that cause changes from solid to liquid and back (e.g. water turns to ice in a freezer and ice turns to water when heated).

**LEVELS OF ATTITUDES, SKILLS & TECHNOLOGY EXPECTED AT
GRADES K - 2**

ATTITUDES:

Students should be encouraged to:

Curiosity:	<ul style="list-style-type: none">✓ Ask questions about objects and events.✓ Find out more about events and objects on their own.
Inventiveness:	<ul style="list-style-type: none">✓ Suggest new ways of doing things.
Respect For Evidence	<ul style="list-style-type: none">✓ Explain their results and conclusions.✓ Listen to other students' results and explanations.
Persistence	<ul style="list-style-type: none">✓ Complete activities.✓ Persist at tasks.
Respect For Living Things	<ul style="list-style-type: none">✓ Show sensitivity to living things.
Cooperation	<ul style="list-style-type: none">✓ Share with others.✓ Work together with others.
Concern For Safety	<ul style="list-style-type: none">✓ Observe safety instructions.

SKILLS:

In developing their skills of inquiry, problem solving and design, the students are expected to:

Observing	<ul style="list-style-type: none"> ✓ Use as many senses as are appropriate and safe to gather information. ✓ Identify differences and similarities between objects and events. ✓ Identify sequence in events.
Measuring	<ul style="list-style-type: none"> ✓ Use simple measuring instruments or models of measuring instruments. At first use comparative terms such as bigger, smaller and later use actual figures.
Manipulating	<ul style="list-style-type: none"> ✓ Set up simple experiments to compare results. ✓ Manipulate simple equipment.
Recording	<ul style="list-style-type: none"> ✓ Use pictures and charts to report results. ✓ Fill out simple tables to report results.
Classifying	<ul style="list-style-type: none"> ✓ Group objects according to one or two criteria.
Communicating	<ul style="list-style-type: none"> ✓ Talk freely about their activities and the ideas they have, with or without making a written record. ✓ Use appropriate vocabulary to describe their observations. ✓ Listen to others' ideas and look at their results. ✓ Report events by using demonstrations, role play, simple drawings, paintings and simple sentences.
Inferring	<ul style="list-style-type: none"> ✓ Notice patterns in simple measurements and events.
Interpreting data	<ul style="list-style-type: none"> ✓ Discuss what they find out in response to questions.
Experimenting	<ul style="list-style-type: none"> ✓ Freely ask a variety of questions and suggest how they might be answered. ✓ Suggest how they could investigate to find out answers to questions.
Predicting	<ul style="list-style-type: none"> ✓ Attempt to make predictions (even if not based on patterns).
Problem Solving	<ul style="list-style-type: none"> ✓ Suggest solutions to simple problems.
Designing	<ul style="list-style-type: none"> ✓ Construct models either by following instructions or by using their own designs. ✓ Select appropriate material to make models and gadgets.

<p>Technological Methods</p>	<ul style="list-style-type: none"> ✓ Given problems, the student will be able to discuss and make simple gadgets.
<p>Nature Of Technology</p>	<ul style="list-style-type: none"> ✓ Realize that some things are natural and people for their use make others. ✓ Realize that people use natural things and also make other things from them. ✓ Realize that they can design and make things which may be different from what others make. ✓ Share information with others. ✓ Realize that safety is important in using tools and making things.
<p><u>Use Of Technology</u></p>	<ul style="list-style-type: none"> ✓ Appreciate the use of devices, tools and structures made by humans in the home and community. ✓ Appreciate the advantages of using these products. ✓ Realize that human-made things can pollute the environment.

UNIT : MATTER AND MATERIALS (GRADE K)

DURATION: 6 Lessons (30 minutes each)

OBJECTIVES

Students should be able to:

1. Identify and describe objects according to properties such as colour, size, shape and texture.
2. Distinguish between objects and the materials from which they are made.
3. Choose materials to make an object of their choice.
4. Make an object using the materials they chose.

PROCESS SKILLS

Observing, Classifying

MATERIALS

Bottles, jars, cans, toys, shoes, bags, materials in the environment (home, school, business), materials to make objects like paper fans, etc.

CONTENT SUMMARY

- There are many objects and materials found in the home, school, supermarkets and the environment which are made from plastics, glass, metals, wood, paper.
- Objects may have different colours (red, blue, green etc.), shapes (square, triangular, round, rectangular etc), sizes (big, small, etc.) and textures (smooth or rough, soft or hard).
- Certain materials are better than others for making a specific object.

Vocabulary

Colour: blue, green, etc.

Shape: round, square, triangular

Size: large than, smaller than, small, smaller, smallest

Texture: rough, smooth

STUDENT ACTIVITIES

- Let students collect empty containers such as bottles, jars, tins, cans, and toys etc. Provide/collect sheets of paper, manila, newspapers, and books.
- Students are asked to name the objects and say what each is made from (e.g. object book – made from paper).
- Students classify collection of objects according to the material they are made of (plastics, metals, paper, etc.).
- Sort plastic bottles according to shapes, colour, size, and texture. N.B. (sorting is done for various types of materials collected). Help students to develop the appropriate vocabulary to describe the properties.
- Present students with containers/bottles with wide/narrow mouth and let them suggest reasons for the different shape/size.
- Activity can be repeated with balls of different sizes.
- Let students suggest reasons why balls are round and not triangular or rectangular.
- Let students suggest something they would like to make (a fan, a pencil holder, an animal etc.). Ask them which of the materials on display they would choose.
- Let students talk about what they would make, choose their materials and construct their object. *(Some students may need help to decide on their choice. In this case the teacher can have a more structured activity in which the children are given instructions to make a particular object, such as a kite, a windmill, pot holders, etc.).*

ASSESSMENT

1. Riddles: Teacher gives students clues: students should state what the object is. For example: I am round, I bounce high, I am made of rubber. What am I?
2. Teacher assesses students' efforts when they make their objects. Let students show and tell about their object and how it is to be used.
3. Teacher provides students with worksheet containing pictures of items of different colours, size and shape and ask students to classify the items.

Integration:

Art- colour

Mathematics-shapes

Literacy-spelling, vocabulary

UNIT : MATTER AND MATERIALS (GRADE 1)

DURATION: 3 lessons

OBJECTIVES

Students should be able to:

- Classify objects as being made of plastics, metals, glass, paper and wood (properties)
- List some properties of plastics, metals, glass, paper and wood
- List some uses of plastics, metals, glass, paper and wood.
- Suggest reasons for the choice of material from which objects are made.

PROCESS SKILLS

Manipulating, Observing, Classifying, Inferring and Communicating.

MATERIALS

A variety of objects in each category of materials: e.g. several different objects made of metals, several objects made of wood, several objects made of plastic etc.

CONTENT SUMMARY

- Objects are made from different materials, wood, plastic, clay, metals, glass, rubber, etc.
- Each of these materials has particular properties, e.g. plastic is smooth, comes in many colours, some types break and some types do not: some plastics bend and others do not; metals are usually shiny, hard, make a clanging sound, etc.
- The use to which the object is to be put determines the materials from which it is made. (e.g. Pots are made from metals because they have to withstand heat. Some balls are made from rubber because we need them to bounce).

STUDENT ACTIVITIES

- Present students with a group of objects made from one of the materials and have them examine the properties of the group (appearance, texture, ability to bend easily, transparency, etc.)

- Let students continue to investigate the different materials and record the properties by ticking in the appropriate column of a table (hard, soft, breakable, difficult to break, easy to bend, etc.).
- Let students compare the same object made from different materials, for example a plastic cup and a glass cup. Let them tick in the properties on a table such as:

	Can break	Cannot break	Can see through	Cannot see through Etc.
Plastic cup (Drawing)		✓		✓
Glass (Drawing) etc	✓		✓	
Plastic lunch kit				
Pot made of plastic				

- Let students say what each object is used for and under which circumstances it is better to use one or the other
- Let students make up stories: A lunch kit was made of paper. A lunch kit was made of glass, Mum's wooden pot , etc. They read/relate their stories to the class.

ASSESSMENT

1. Teacher sets up stations with objects made of different materials. Students go to the stations and identify the object and the material from which it is made.
2. Teacher asks students to name objects with different properties. For example: Name an object that is transparent and can break; what material is it made of?
3. Students can prepare their Materials scrap book with pictures of objects made from each type of material (metal, plastic, clay, paper, glass etc).
4. The guessing game. Let students guess what an object is from information given about that object, such as: I can have any colour, I can be worn, I am made of fabric, I can have pockets, and I have two legs. What am I?

UNIT: MATTER AND MATERIALS (GRADE 2)

DURATION: 4 Lessons

OBJECTIVES

Students should be able to:

- Identify different materials such as wood, glass, clay, plastic, rubber and metal.
- List the properties of these materials.
- Investigate and compare the hardness, and strength (wood, plastic, metal, clay, paper etc.).
- Match properties of materials to their use.

PROCESS SKILLS

Observing, Classifying, Inferring

MATERIALS

Plastics, metals, glass, rubber, wood, and clay

CONTENT SUMMARY

- Different materials have different properties that determine the uses to which they are put.
- **Hardness** refers to how easy it is to dent or scratch a material. We can compare hardness by testing if one material can cause a dent to another or if one material can be scratched by another. A harder material will scratch a softer one.
- **Strength** refers to how easy it is to tear or break a material or how much load the material can support before it breaks.

Wood

- (1) Hard
- (2) Can be shaped easily
- (3) Can burn easily
- (4) Is relatively light

Plastic

- (1) Most melt easily
- (2) Can be shaped easily
- (3) Some types are harder than others
- (4) Is relatively light

Clay

- (1) Soft when wet
- (2) Can be shaped when wet
- (2) Maintain shape when dry
- (3) Shatters easily when dry

Glass

- (1) Transparent
- (2) Hard
- (3) Smooth
- (4) Shatters easily

Paper

- (1) Light weight
- (2) Can be shaped easily
- (3) Burns easily

Rubber

- (1) Can be easily shaped
- (2) Stretches/elastic

Metal

- (1) Hard
- (2) Can withstand heat
- (3) Can be shaped easily

STUDENT ACTIVITIES

- Let students make a list of many objects found in the classroom and school environs and tick the material each is made from– metal, plastic, glass, rubber, clay, paper etc. (NB students are given a worksheet to record their observations)
- Extend activity to include materials in the home.
- Let students list as many properties of the materials as they can.

- *Comparing hardness of materials:*

Let students say what they mean when they describe a material as hard. Help them to clarify the meaning of “hard” (e.g. hard materials do not sink in or bend when we press them. Hard materials are not scratched easily).

Let students identify hard materials in use (e.g. for their desk tops, table tops, walls, floors, roads, etc.). Let students compare these hard things with soft things (that sink in when we press them).

Let students hypothesize about which of the following materials is hardest (modelling **clay**, a **metal** nail, a **wooden** twig or match stick, a **plastic** pen.

Then let them compare the hardness of the materials.

Let students use each material to try to scratch the other.

Let them record their results in a table. A harder material will scratch a softer material (e.g. a metal nail will scratch wood, therefore the metal is harder than wood.)

Let students arrange the materials in order of hardness.

- *Comparing the strength of materials*
Ask students to point out strong materials and let them explain what they understand by strong.
Help students to clarify the meaning of strong (i.e. how easily does the material tear or break, how well does it support heavy loads).
Let students try to tear sheets of paper, plastic bags, aluminum foil, pieces of string to get the idea of different strengths.

Ask students which of the following will tear easily: paper or metal.
Help them realize that strength will depend on the thickness of the material.
- Let students look around the school or home for evidence of materials supporting different loads without breaking: for example, a cardboard box supports the weight of books, wooden beams support houses, metal/wooden chairs support the weight of people.
- Teacher can help students investigate which is stronger – a plastic bag or a paper bag.
- Let students discuss how the choice of material depends on the purpose for which it will be used.

ASSESSMENT

1. Name or give students pictures of objects.
 - (a) Let them state the use of the objects.
 - (b) Let them identify the materials from which the objects are made.
 - (c) Let them justify the choice of materials for these objects.

Example: A bed with mattress and pillows (some materials are hard, some strong, some hard, etc.
2. Opportunities for assessment of skills are provided as students fill out tables, compare materials, investigate the properties of materials.

DURATION: **6 Lessons**

OBJECTIVES

Students should be able to:

- Design an object for a particular use.
- Choose materials suitable for making an object to be used for a particular purpose.
- Make an object for a particular use

PROCESS SKILLS

Problem solving, Manipulating, Cooperating

MATERIALS

Plastics, glass, paper, metal cans, rubber, clay and popsicle sticks, wood, cardboard, glue, etc.

CONTENT SUMMARY

People design and make things to suit particular purposes.
We choose materials because they have certain properties.
Review content in previous lessons.

STUDENT ACTIVITIES

Teacher creates a context , for example: In our classroom we need something to store all our crayons, or to carry books around in the classroom. What can we make to solve this problem?

Students are to work in groups.

They plan what they will make: they make a sketch: they choose the materials they will need.

They make their object.

They test if it is suitable for its purpose.

ASSESSMENT

As students work on their design and make project, the teacher can assess them using different criteria, such as: planning, choice of materials, final product, problem solving skills and cooperating.

DURATION: 2 Lessons

OBJECTIVES

Students should be able to:

- (1) Describe the properties of solids and liquids (using the senses).
- (2) Give examples of solids and liquids.

PROCESS SKILLS

Observing, Manipulating, Communicating and Classifying

MATERIALS

Transparent plastic cups of different shapes and sizes; an assortment of solid items: wooden blocks, coins, stones, etc.; a variety of liquids: water, cooking oil, alcohol, vinegar, etc.

CONTENT SUMMARY

- Many of the materials around us are either solids or liquids
- Solids - keep their shape
 - are usually hard
- Liquids - can be poured
 - change shape depending on container

SUGGESTED ACTIVITIES

1. Set up several stations within classroom placing solid items and liquid items at separate stations. Divide class into small groups and let them visit one solid and liquid station and observe/interact with the materials. (Instruct them not to put anything in their mouths). Instruct students to pour liquids and place solids into different containers provided at the stations.
2. Engage students/whole class in a discussion aimed at establishing the properties of liquids and solids. Use simple questions such as:
 - How does the stone feel?
 - Was it easy to squeeze the piece of wood?
 - Did the piece of wood change its shape when placed in the cup?
 - What happened to the shape of the oil when poured into the narrow container/wide container?Introduce the concept of solid and liquid to end discussion.
3. Let students give examples of other solids and liquids
4. Take home activity. Challenge students to list all the solid and liquid items in their homes.

ASSESSMENT

1. Present students with an assortment of items not previously used and ask them to group items as solids or liquids.
2. Play a 'What am I?' game: students draw a flash card from a prepared pack. (Each card should have the name of a solid or liquid item written on it). The student is then required to do three things:
 - (1) Identify with the item by making a sample statement:
I am -----.
 - (2) State whether it is solid or liquid: I am a -----.
 - (3) State one property of the substance: I am hard etc.

DURATION: 4 Lessons

OBJECTIVES

Students should be able to:

1. Recognize that water can be solid or liquid.
2. Identify the conditions under which water changes from solid to liquid and back.

PROCESS SKILLS

Predicting, Observing

MATERIALS

Water, ice, refrigerator, cups, metal containers, heat source, bottle stoppers

CONTENT SUMMARY

- Water can exist as a solid (ice) or as a liquid (what we call water).
- Solid water (ice) will change to a liquid when exposed to heat.
- Liquid water will change to a solid water (ice) when placed in a very cold place.

SUGGESTED ACTIVITIES

1. Engage and involve students in the planning of an activity/experiment/investigation aimed at finding out conditions necessary for freezing. Investigation could involve many water bottles in the freezing and cooling compartments of the refrigerator. Set up experiment and then let students make predictions (experiment to be done overnight).
2. Remove item from refrigerator and engage students in discussions, paying attention to the predictions made earlier.
3. Select three blocks of ice similar in size and inform students of the intent to let them race to see which one melts the fastest: one block should be left sitting on a table at room temperature, one should be placed over a heating source and one in the cooling compartment of refrigerator. Let students make predictions as to which one will melt first, second, etc. At the completion of the activity engage students in a discussion aimed at establishing the concept that exposure to heat caused the solid water (ice) to change to liquid water (water); and that the more heat there is the faster the ice will melt.

ASSESSMENT

Let a few students pretend to be water/ice then question the rest of the class as to what will happen to them if they were:

- placed in the cooler? (for water and ice)
- placed in the freezer? (for water and ice)
- placed in the sun? (for ice)
- placed on the fire? (for ice)

DURATION: 2 Lessons

OBJECTIVES

Students should be able to:

- (1) Name examples of liquids found in the home.
- (2) Compare the properties of liquids used in the home.

MATERIALS

An assortment of liquids commonly used in the home, such as vinegar, baby oil, ketchup, drinks, glue, honey.

CONTENT SUMMARY

- Many materials we use in our home are liquids.
- Liquids can be poured, and takes the shape of their containers
- Some liquids pour more easily than others.

SUGGESTED ACTIVITIES

1. Teacher assembles liquids commonly used in the home. Students give the use of the liquids.
2. Teacher asks students to list the characteristics of the liquids shown.
3. Teacher asks students which liquid will flow most easily? If we had a race, which liquid would drip out of the container the fastest?
4. Students make hypotheses. Teacher asks students to suggest how they might test their hypotheses.
5. Teacher helps students design an experiment to compare how quickly the liquids flow.
6. Students set up their experiments and record their results.
7. Students arrange the liquids in order of how quickly they pour.

ASSESSMENT

1. Teacher should assess students as they do their experiments for communication skills, inferring, observing, etc.
2. Let students complete a worksheet on the liquids shown to show simple characteristics of these liquids, such as colour, smell, etc.

MODULE 2

Matter and materials

Grades 3 - 4

GENERAL OBJECTIVES

The students should be able to:

1. Understand that the amount of matter and the space it occupies can be measured
2. appreciate that materials may interact differently with other materials and objects.

SPECIFIC OBJECTIVES:

The students should be able to:

1. List some physical properties of matter.
2. Determine the physical properties (e.g. length) of matter by using instruments thermometers, rulers, etc).
3. Measure definite volume and mass of materials.
4. Give examples of physical change.
5. Use a variety of ways and measurements to compare and contrast the physical properties of materials (soluble, insoluble, conductors, non-conductors of heat and electricity).
6. Describe the effect of magnets on materials.
7. Describe the use of magnets in the home and community.
8. Suggest novel ways of using magnets in the home or school.
9. Demonstrate that certain materials reflect, transmit or absorb light.
10. Describe and give examples of transparent, translucent and opaque materials.
11. Identify properties of materials that make them suitable for specific purposes.
12. Compare objects used for the same purpose but made of different materials and list the advantages and disadvantages of using each type of material.

**LEVELS OF ATTITUDES, SKILLS & TECHNOLOGY EXPECTED AT
GRADES 3 - 4**

ATTITUDES:

Students should be encouraged to:

Curiosity:	<ul style="list-style-type: none"> ✓ Ask questions about objects and events. ✓ Find out more about events and objects on their own.
Inventiveness:	<ul style="list-style-type: none"> ✓ Suggest new ways of doing things. ✓ Use equipment in novel ways.
Respect For Evidence	<ul style="list-style-type: none"> ✓ Explain their results and conclusions using some evidence. ✓ Listen to other students' results and explanations. ✓ Begin to recognize when conclusions do not fit the evidence.
Persistence	<ul style="list-style-type: none"> ✓ Complete activities. ✓ Persist at tasks.
Respect For Living Things	<ul style="list-style-type: none"> ✓ Show sensitivity to living things.
Cooperation	<ul style="list-style-type: none"> ✓ Share with others. ✓ Work together with others. ✓ Accept responsibilities.
Concern For Safety	<ul style="list-style-type: none"> ✓ Observe safety instructions.

SKILLS:	In developing their skills of inquiry, problem solving and design, the students are expected to:
Observing	<ul style="list-style-type: none"> ✓ Use as many senses as are appropriate and safe to gather information. ✓ Identify differences and similarities between objects and events. ✓ Identify sequence in events.
Measuring	<ul style="list-style-type: none"> ✓ Use simple measuring instruments or models of measuring instruments. At first use comparative terms such as bigger, smaller, and later use actual figures.
Manipulating	<ul style="list-style-type: none"> ✓ Set up simple experiments to compare results. ✓ Manipulate simple equipment.
Recording	<ul style="list-style-type: none"> ✓ Use pictures and charts to report results. ✓ Fill out simple tables to report results.
Classifying	<ul style="list-style-type: none"> ✓ Group objects according to several criteria.
Communicating	<ul style="list-style-type: none"> ✓ Talk freely about their activities and the ideas they have, with or without making a written record. ✓ Use appropriate vocabulary to describe their observations. ✓ Listen to others' ideas and look at their results. ✓ Report events by using demonstrations, role play, simple drawings, paintings and paragraphs. ✓ Use bar graphs, pictures, tables and charts to report results. ✓ Use books and other sources to find information.

SKILLS CONT'D

Inferring	<ul style="list-style-type: none"> ✓ Notice patterns and relationships in simple measurements and events.
Interpreting data	<ul style="list-style-type: none"> ✓ Discuss what they find out in response to questions. ✓ Compare their findings with their predictions. ✓ Notice changes when one variable is changed.
Experimenting	<ul style="list-style-type: none"> ✓ Freely ask a variety of questions and suggest how they might be answered. ✓ Suggest how they could investigate to find out answers to questions. ✓ Have some idea of the variable that has to be changed or what different things are to be compared in an investigation. ✓ Suggest equipment, materials and procedure for conducting investigations.
Predicting	<ul style="list-style-type: none"> ✓ Attempt to use evidence in making predictions.
Hypothesizing	<ul style="list-style-type: none"> ✓ Attempt to explain things that are consistent with evidence. ✓ Suggest how something may have happened.
Problem Solving	<ul style="list-style-type: none"> ✓ Suggest solutions to simple problems.
Designing	<ul style="list-style-type: none"> ✓ Construct models either by following instructions or by using their own designs. ✓ Select appropriate material to make models and gadgets. ✓ Formulate problems, do appropriate research, and devise solutions. ✓ Select appropriate material to make models and gadgets. ✓ Evaluate their own designs using simple criteria.

TECHNOLOGY

<p>Technological Methods</p>	<ul style="list-style-type: none"> ✓ Students will be able to formulate problems, do appropriate research and devise solutions (e.g. construct gadgets).
<p>Nature Of Technology</p>	<ul style="list-style-type: none"> ✓ Look at past inventions in their historical context. ✓ Understand that products are replicable. ✓ Understand that others may be working on the same idea. ✓ Realise that <i>they can use scientific knowledge in doing technology</i> and that technology helps to develop reliable scientific information. ✓ Understand the importance of precision and safety in developing new products. ✓ Understand that technology is novel and creative. ✓ Understand that if the people in a country are creative and innovative, their country can progress. ✓ Understand that people use processes involving living things (Biotechnology) and materials (Production Technology) to satisfy their needs.
<p><u>Use Of Technology</u></p>	<ul style="list-style-type: none"> ✓ Appreciate the use of devices, tools and structures made by humans in the home and community. ✓ Appreciate the advantages of using these products. ✓ Realize that human-made things can pollute the environment. ✓ Look at advantages and disadvantages to help them make decisions of what is the best technology that can be used in a particular situation. ✓ Realize that people may abuse and misuse technology. ✓ Understand that technology may have unintended consequences.

Unit: matter and materials (grade 3)

DURATION: 2 Lessons

OBJECTIVES

Students should be able to:

1. Identify properties of materials that make them suitable for specific purposes.
2. Compare objects used for the same purpose but made of different materials and list the advantages and disadvantages of using each type of material.

PROCESS SKILLS

Observing, Manipulating, Inferring.

MATERIALS

A wide variety of objects including cooking pots, various boxes, bottles, cans, pot holders, thermometers, coins, sunglasses, etc.
Pictures of large pieces of equipment e.g. aero-planes, cars, furniture etc.

CONTENT SUMMARY

- The properties of a material determine its use.
- The most suitable material is chosen for a particular purpose.

SUGGESTED ACTIVITIES

- Introduce a piece of equipment to the children (e.g. cooking pot) and ask them to list the materials that the item is made of.
Ask students why they think the particular materials were chosen to make the item.
Ensure that students are connecting the material with its properties and use by asking questions such as:
 - i. Why has wood been chosen to make the handle of the pan?
 - ii. Why hasn't the same material been chosen to make the pan?
 - iii. What might happen if plastic had been used for the pan and metal for the handle?

- Let students examine other items themselves discussing their ideas within groups and recording their findings.
- Students examine pictures of larger items e.g. cars.
- Students list as many materials as they can that the item may be made of and say what property of the materials make them suitable for their use.

For example a car:

Glass (windshield windows), transparent

Rubber (tyres), flexibility

Metal (frame etc), strength

Glass (mirror), reflective.

- Teacher displays objects (or pictures) made for the same purpose, but made of different materials (e.g. furniture, floors, school bags etc). Teacher has students list the properties they would want in the particular object. Students use these to draw up a list of criteria. Students draw up a table with the criteria. They evaluate the objects (made from the different materials) using these criteria.

ASSESSMENT

Complete the table

Item	Materials	Reason
An envelope	Rubber, Glass Metal, Paper	
A waterproof coat	Paper, Plastic Wood, Cloth	
A fireguard	Plastic, Metal Wood, Rubber	
A kite	Stone, Metal Wood, Paper	

DURATION: 3 Lessons

OBJECTIVES

Students should be able to:

1. Give examples of soluble and insoluble materials.
2. Compare and contrast the ability of materials to dissolve in water.

PROCESS SKILLS

Observing, Manipulating, Experimenting, Recording.

MATERIALS

Sugar, salt, flour, sand, coffee, talcum powder, kool Aid, plastic spoons, transparent containers, water, hand lens.

CONTENT SUMMARY

- Some materials can dissolve in liquids. They are said to be soluble. A dissolved material and the liquid in which it is dissolved make a mixture called a **solution**.
- Some materials do not dissolve in water. They are insoluble.

SUGGESTED ACTIVITIES

Dissolving

- Explain to students that they are going to investigate which materials dissolve in water.
Discuss the concept of dissolving.
Put students into groups and distribute the materials. Students examine the materials using a hand lens.
Students put a spoonful of each material into separate jars of water and stir. Record observations on a recording sheet provided.

Record sheet

Name of material	What happened when the material was mixed with water?	Was it soluble or insoluble?

When testing is finished, students group jars according to whether the mixture they contain is a solution or not.

Students compare their results with those of other groups.

- Students name solutions in the classroom and at home. They discuss their use.

ASSESSMENT

- Students do the following: Plan and carry out experiments to compare how well certain materials dissolve in water.
- Classify a list of given substances as soluble or insoluble.
- Make a list of instances where dissolving is useful in everyday life. e.g. cooking.
- Teachers will assess students' record sheet.

DURATION: 4 Lessons

OBJECTIVES

Students should be able to:

1. Give examples of materials that conduct heat and those that do not (insulators).
2. Compare and contrast the ability of materials to conduct heat.
3. Design and make a device to keep a liquid warm or cold.

PROCESS SKILLS

Observing, Manipulating, Experimenting, Planning, Designing

MATERIALS

Similar items made from different materials (wood, plastic, glass, metal, rubber) hot water.

CONTENT SUMMARY

- If heat travels easily through a material the material is a good conductor of heat.
- If heat does not travel easily through a material, that material is an insulator.
- Examples of conductors of heat are metals.
- Examples of non-conductors of heat are wood and plastic.

SUGGESTED ACTIVITIES

- Teacher asks students to consider what happens when they put pans on the stove. Parts of the pan that are not directly heated also get hot. Why do we need pot holders? What do we use for potholders?

Simple discussion on the idea that heat travels through some materials but not others. Teacher introduces the terms 'conductor' and 'insulator'.

- Students are shown similar objects (of the same size, thickness, shape) e.g. plastic, wooden and metal rulers or plastic, wooden and metal spoons, etc.
Discuss with students how they could find out which materials conduct heat best. Teacher asks students to make hypotheses as to which material would conduct heat best.
In groups, students are given a container of hot water and the similar materials. Each material is placed into the container of hot water for a set amount of time. (Remind students to be careful) After the time

elapses, students feel the dry end of the materials to determine which one feels warmest. Students record observations. Students rate the materials as conductors or insulators.

- Students provide examples of other conductors and insulators. They discuss how these materials are useful in different situations.
- (Optional) To demonstrate how heat is conducted through materials tell the students that all things are made up of very small particles. Each of them is going to pretend to be a particle and you, the teacher, are the heat source.

The students should sit fairly close together. As the heat source approaches the first student (particle), the student begins to vibrate (jiggle) but remains in the same spot. The student in contact with the first student begins to jiggle. The pattern continues until all the students are moving.

Explain to students that the molecules of an insulator would be affected by heat slowly so there will be less vibrating and so very little heat will be passed on. Demonstrate this as in the activity above. NB - Most of the students should remain still.

- Challenge: Students in groups, design and make an object which can be used to keep liquids hot/cold. They have a competition to see whose design will keep the liquid hot or cold longest.

ASSESSMENT

- Given a list of materials students classify them as insulators or conductors.
- Given specific situations students decide whether a conductor or insulator would be appropriate. For example, what type of material is best suited to make pot handles?
- Make a list of instances of conductors/insulators in the home.
- Assess certain skills and attitudes as students make the Technology product.

DURATION: 3 Lessons

OBJECTIVES

Students should be able to:

1. Demonstrate that certain materials reflect, transmit or absorb light.
2. Describe and give examples of transparent, translucent and opaque materials.
3. Identify uses of transparent, translucent and opaque materials.
4. Compare objects used for the same purpose but made of transparent, translucent or opaque materials.

PROCESS SKILLS

Observing, Classifying, Analyzing, Manipulating

MATERIALS

Clear plastic, wood, coin, cup, glass, light bulb, white paper, and flashlight.

CONTENT SUMMARY

- Different materials react differently to light.
- Some materials transmit light while others do not.
Transmit – the material allows light to pass through it.
Materials that allow most of the light to pass through them are **transparent** e.g. clear glass and clear plastic.
Materials that allow some light to pass through them are **translucent** e.g. wax paper, some types of plastic and glass.
- Materials that do not allow light to pass through them are **opaque** e.g. wood, clay, rubber, some plastics.

Opaque materials may reflect or absorb light.

Reflect – the material 'sends the light back or in another direction, e.g. smooth, shiny surfaces which act like mirrors reflect light.

Absorb – the material takes the light in e.g. dark, dull clay

SUGGESTED ACTIVITIES

Put students into groups and distribute clear plastic, wood, coin, cup, glass, light bulb, aluminium foil, a mirror, white paper and flashlight.

Activity 1:

Students set up the activity by placing each object between the flashlight and the white paper, and turning on the flashlight. For each item students' record:

- a. If the light shines through the object.
- b. If the light is stopped by the object.
- c. If some light goes through the object.

Students also hold the white paper on the same side as the light and see if they can see the light on the paper.

Discuss students observations and introduce and discuss the concepts of transmit, reflect, transparent, translucent and opaque.

Ask questions such as:

1. Which objects formed shadows? Why?
2. Can transparent objects form shadows? Why?

Activity 2

Provide students with a variety of other objects. Students make predictions as to which ones they think will allow light to pass through them and which will stop light from passing through them. Students test their predictions by repeating Activity 1.

Students record their observation and write a description of transparent, translucent and opaque materials.

Activity 3

Teacher presents students with three drinking containers or bags, one transparent, one translucent and one opaque. Students discuss the disadvantages and advantages of using one or the other.

Activity 4

Students carry out an inventory at home to identify transparent, translucent and opaque materials and to state how it is important for them to have the particular property e.g. frosted glass-privacy.

ASSESSMENT

- Given a list of materials students classify them as transparent, translucent, or opaque` .
- Teacher can assess students' performance on Activities 2, 3 and 4.
- Students design and make a sundial and explain how it works.

Unit: matter and materials (grade 4)

DURATION: 4 Lessons

OBJECTIVES

Students should be able to:

1. Measure volume and mass of materials.

PROCESS SKILLS

Manipulating, Recording, Observing

MATERIALS

Rulers, assorted cuboids, measuring cylinders, balances/scales, assorted objects.

CONTENT SUMMARY

- All objects occupy space.
- The amount of space that an object takes up is called its volume.
- The volume of a regular solid, like a box, can be found by measuring the length, width and height (with a ruler) and then multiplying the length by the width by the height.
- The volume of a liquid can be found using a measuring cylinder marked in cm^3 .
- The mass of an object is the amount of matter in the object. Mass is measured with a balance and the unit of mass is grams or kilograms.

STUDENT ACTIVITIES

Activity 1

- Let students examine measuring cylinders and discuss how to use them correctly
Get 3 cups of different sizes. Fill each cup with water and label the cups 1, 2, 3.
Let students estimate the volume of water in each cup.
Pour the water from 1 into the measuring cylinder and record the volume.
Repeat the process and record the volume of water in cups 2 and 3
Compare the volume of water that each cup can hold.

- Create some problem situations for students: - For example:
What happens to the volume of each liquid as we pour them from one cup to another of a different shape etc?
Let students predict and test their predictions.

Activity 2

- Give students an assortment of cubes and cuboids. Pupils identify the length, width and height. (N.B. ensure that the dimensions are regular).
Discuss the formula for calculating volume. (Link with Mathematics)

Using rulers, students measure and record the length, width and height of the boxes/books.

Students record their measurement on a recording sheet.

Object	Length	Width	Height	Volume

Activity 3

- Explain the concept of mass.
Present balances/kitchen scales and discuss their use and how they work.
Students are given an assortment of objects and use the balances/scales to Record the mass of each unit.

Activity 4

- Create problem situations for students: For example -
Would the same volume of different materials have the same volume?

Let students predict and test their predictions.

ASSESSMENT

- Assessment of record sheets.
- Students write instructions on how to find the volume/mass of an object
- Students estimate the mass/volume of an object and measure and record the actual mass/volume of the object.

DURATION: 3 Lessons

SPECIFIC OBJECTIVES

Students should be able to:

- (i) List the physical properties of matter.
- (ii) Determine the physical properties of matter by using instruments.
- (iii) Construct an instrument to measure mass or volume.

PROCESS SKILLS

Manipulating, Recording, Observing

MATERIALS:

Rulers, thermometers, balances, measuring cylinders
An assortment of objects (hot, cold, warm, water)

CONTENT SUMMARY

- An object or material has various characteristics which include length, temperature, mass, volume.
- Some of these characteristics depend on the amount of material we have (mass, volume, length) while others do not (temperature).
- We use a variety of instruments to record the properties of matter:

Length –ruler
Temperature – thermometer
Mass – balance
Volume – measuring cylinder

- When making things it is important to measure accurately.

STUDENT ACTIVITIES

Activity I

- Students are given an assortment of objects and asked to compare them using terms such as:

Heavy – light,
Long – short
Wide – narrow
Warm – cool

Discuss the physical properties of the object using terms such as length, temperature, mass.
Relate the terms used to compare the objects to the properties e.g. warm/cool – temperature.

Activity II

- Students are given rulers. Teacher explains how to use the rulers
Students are given assortment of objects and rulers. Students use their rulers to record the length of the objects (N.B. students may also record the length of objects in the classroom).

Activity III

- Present students with thermometer. Discuss the use of thermometers. Put students in groups and present students with an assortment of liquids at varying temperatures. Students use the thermometers to record the temperature of the liquids. Compare
Students also record room temperature and their body temperature.
- **(Safety precaution – Use underarm thermometers and observe proper hygiene when going from one student to another)**

Activity IV

- Present students with balances/scales. Explain their use.
Students use the balance/scales to record the mass of various objects.
Group members compare their results.

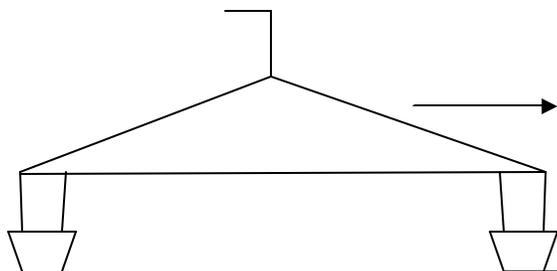
Activity V

- Present students with graduated measuring cylinders. Discuss the use of measuring cylinders.
Students are given a variety of containers filled with water and asked to use the measuring cylinder to determine the volume of water in each container.

Students pour specified, volume of water into their measuring cylinder.

Activity VI

- In groups students construct an instrument using everyday material and demonstrate its use. e.g. A balance



ASSESSMENT

- Given pictures of instruments, pupils identify them and the property they are used to measure.

INSTRUMENT	PROPERTY
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I.



II.



III.



- Assessment of students records from the activities
- Individual students make a book of measurement which should include
 - Diagrams/pictures/model of each instrument
 - The length of their body, toes, feet, fingers, etc
 - Their body temperature, temperature of the classroom
 - Their mass

Students collect and display various containers that have varying volumes.

Rating scale to assess students skills in using measuring instruments.

- Let students follow a recipe or write their own recipes where precise volumes and masses and temperatures are important. By observing the product, teacher can determine how accurate the students were in their measurements of volume, mass, temperature

DURATION: 3 Lessons

OBJECTIVES

Students should be able to:

1. Give examples of physical change.

PROCESS SKILLS

Observing, Manipulating, Analyzing

MATERIALS

Hot water, wax, butter, chocolate, chalk, salt water, candle, matches, containers, plastic cups, stones

CONTENT SUMMARY

- Materials can change.
- We can change their shape, colour, physical state, etc.
- If they only change in appearance e.g. (colour, shape, size, state) the change is known as a **physical change**. Physical changes include change of state, such as from liquid to gas, liquid to solid and the reverse.
- Physical changes can often be reversed easily.

STUDENT ACTIVITIES

Activity 1:

- Put students in groups and give each group chocolate, candle wax, butter, styrofoam cups, hot water, metal bottle stoppers. Students place a small amount of each substance into the bottle stoppers. Float the bottle stoppers on the surface of the hot water, observe what happens to each substance. Record the observation. Remove the stoppers and allow the substances to cool. Observe and record what happens in the table provided.

Items	Appearance before	Appearance after

Activity II

- Put students into groups. Provide each group with chalk. Students wrap the chalk with paper and use the stone to pound the chalk into a powder. Students observe the powder and discuss whether the change is physical.

Activity III

- Students are given salt and some water to make a salt solution. Discuss with students whether the salt has gone through a physical change. Students (with teacher's supervision) use a heat source to evaporate the water from the salt solution. Discuss the observations.

ASSESSMENT

- Assessment of students' record sheets.
- Given a description of changes students determine whether they are physical or not.

MODULE 3

Matter and materials

Grades 5 - 6

GENERAL OBJECTIVES:

The students should be able to:

1. Investigate changes in materials and matter.
2. Classify changes as reversible or irreversible.
3. Appreciate that people bring about changes in materials to satisfy their needs.
4. Appreciate the changes taking place in at least one production process used in the home and one in industry.

SPECIFIC OBJECTIVES:

The students should be able to:

1. Identify and describe different methods by which materials can be changed.
2. Identify melting, freezing, condensation and evaporation as changes of state that can be reversed.
3. Infer that the mass of water remains the same when water changes from solid to liquid.
4. Identify burning, rusting and decaying as changes that are non-reversible.
5. Identify a production process taking place in the home.
6. Draw a diagram to show the stages in the process.
7. Identify and describe changes taking place in the process.
8. Appreciate that humans use production processes to make goods.

LEVELS OF ATTITUDES, SKILLS & TECHNOLOGY EXPECTED AT GRADES 5 - 6

ATTITUDES:

Students should be encouraged to:

Curiosity:	<ul style="list-style-type: none"> ✓ Ask questions about objects and events. ✓ Find out more about events and objects on their own.
Inventiveness:	<ul style="list-style-type: none"> ✓ Suggest new ways of doing things. ✓ Use equipment in novel ways.
Respect For Evidence	<ul style="list-style-type: none"> ✓ Use evidence to justify their conclusions. ✓ Listen to other students' results and explanations. ✓ Recognize when conclusions do not fit the evidence. ✓ Change their ideas in response to evidence. ✓ Point out contradictions in reports by their classmates. ✓ Show a willingness to review procedures and evaluate their work.
Persistence	<ul style="list-style-type: none"> ✓ Complete activities. ✓ Persist at tasks. ✓ Repeat experiments when previous attempts have failed.
Respect For Living Things	<ul style="list-style-type: none"> ✓ Show sensitivity to living things.
Cooperation	<ul style="list-style-type: none"> ✓ Share with others. ✓ Work together with others. ✓ Accept responsibilities.
Concern For Safety	<ul style="list-style-type: none"> ✓ Observe safety instructions.

SKILLS:	
In developing their skills of inquiry, problem solving and design the students are expected to:	
Observing	<ul style="list-style-type: none"> ✓ Use as many senses as are appropriate and safe to gather information. ✓ Identify differences and similarities between objects and events. ✓ Identify sequence in events. ✓ Distinguish from many observations those that are relevant to an investigation.
Measuring	<ul style="list-style-type: none"> ✓ Use simple measuring instruments or models of measuring instruments. ✓ Use units in measurement.
Manipulating	<ul style="list-style-type: none"> ✓ Set up simple experiments to compare results. ✓ Manipulate simple equipment.
Recording	<ul style="list-style-type: none"> ✓ Use pictures and charts to report results. ✓ Fill out simple tables to report results.
Classifying	<ul style="list-style-type: none"> ✓ Group objects according to several criteria.
Communicating	<ul style="list-style-type: none"> ✓ Talk freely about their activities and the ideas they have, with or without making a written record. ✓ Use appropriate vocabulary to describe their observations. ✓ Listen to others' ideas and look at their results. ✓ Write reports on their investigations. ✓ Use bar graphs, pictures, tables and charts to report results. ✓ Regularly and spontaneously use books and other sources to check or supplement investigations. ✓ Select appropriate methods to report events. Include drawings, reports and multi media.

SKILLS CONT'D

Inferring	<ul style="list-style-type: none"> ✓ Notice patterns in data. ✓ Draw reasonable conclusions from data.
Interpreting data	<ul style="list-style-type: none"> ✓ Discuss what they find out in response to questions. ✓ Compare their findings with their predictions. ✓ Make associations with change in variables and results.
Experimenting	<ul style="list-style-type: none"> ✓ Freely ask a variety of questions and suggest how they might be answered. ✓ Formulate problems to be investigated. ✓ Suggest how they could investigate to find out answers to questions. ✓ Plan to conduct investigations. Select equipment, materials and procedures for conducting investigations. ✓ Understand what is a fair test. ✓ Keep appropriate variables constant and vary the independent variable in experiments.
Predicting	<ul style="list-style-type: none"> ✓ Use evidence in making predictions. ✓ Show how they have used evidence in making predictions.
Hypothesizing	<ul style="list-style-type: none"> ✓ Attempt to explain things that are consistent with evidence. ✓ Suggest how something may have happened.
Problem Solving	<ul style="list-style-type: none"> ✓ Suggest solutions to simple problems. ✓ Identify needs, formulate questions, conduct research and design solutions to problems.
Designing	<ul style="list-style-type: none"> ✓ Construct models either by following instructions or by using their own designs ✓ Select appropriate material to make models and gadgets. ✓ Formulate problems, do appropriate research, and devise solutions. ✓ Select appropriate material to make models and gadgets. ✓ Evaluate their own designs and the designs of others using simple criteria.

<p>Technological Methods</p>	<ul style="list-style-type: none"> ✓ Students will be able to formulate problems, do appropriate research and devise solutions (e.g. construct gadgets).
<p>Nature Of Technology</p>	<ul style="list-style-type: none"> ✓ Look at past inventions in their historical context. ✓ Understand that products are replicable. ✓ Understand that others may be working on the same idea. ✓ Realise that <i>they can use scientific knowledge in doing technology</i> and that technology helps to develop reliable scientific information. ✓ Understand the importance of precision and safety in developing new products. ✓ Understand that technology is novel and creative. ✓ Understand that if the people in a country are creative and innovative, their country can progress. ✓ <i>Understand that people use processes involving living things (Biotechnology) and materials (Production Technology) to satisfy their needs.</i>
<p><u>Use Of Technology</u></p>	<ul style="list-style-type: none"> ✓ Appreciate the use of devices, tools and structures made by humans in the home and community. ✓ Appreciate the advantages of using these products. ✓ Realize that human-made things can pollute the environment. ✓ Look at advantages and disadvantages to help them make decisions of what is the best technology that can be used in a particular situation. ✓ Realize that people may abuse and misuse technology. ✓ Understand that technology may have unintended consequences.

Unit: matter and materials (grade 5)

DURATION: 2 Lessons

OBJECTIVES

Students should be able to:

1. Identify and describe different ways in which materials can be changed.

PROCESS SKILLS

Observing, Communicating, Classifying

MATERIALS

Sheet of paper
Pair of scissors
Water, ice,
Salt
Plastic cups
Spoons
Sticks
Lime
Baking soda
Sand
Kool Aid

CONTENT SUMMARY

- In everyday life, materials undergo changes.
- Some ways in which materials can be changed include: change of state(melting, boiling, freezing, etc.); change of size or shape; by mixing (e.g. making solutions and suspensions) ; by reacting (e.g. baking soda and lime juice); by cooking (boiling eggs)

SUGGESTED ACTIVITIES

- Let students cut a sheet of paper into small bits and compare with the original.
- Break sticks and compare with the original.

- Let students make mixtures with water and salt or sand and other mixtures.
- Teacher will place a few drops of bleach on a piece of fabric and then ask students to observe any changes taking place
- Let students place a few drops of limejuice on baking soda and then observe the changes.
- Teacher presents students with cooked and uncooked eggs and ask students to compare them.
- Teacher lets students melt ice and boil and freeze water and describe the changes.
-
- Students are to record all changes observed. Students conclude that some ways we can change materials are: by changing their state (solid, liquid or gas); change of shape or size or physical appearance; by mixing, by reacting, by cooking.

ASSESSMENT

In the space provided, classify each of the following changes as change of state, change of shape etc; change by mixing, change by reacting

1. Melting butter	5. Chopping wood
2. Mixing salt and water	6. Mixing flour and water
3. Waxing a floor	7. Breaking glass
4. Boiling water	8. Painting wood

DURATION: 2 Lessons

OBJECTIVES

Students should be able to:

1. Identify melting and freezing as changes of state.
2. Infer that change of state can be reversed
3. Infer that the mass of water remains the same when water changes from solid to liquid.

PROCESS SKILLS

Observing, Inferring.

CONTENT SUMMARY

- When we change the same substance from liquid to solid to gas we refer to this as a change of state.
- Changes of state are **reversible**; this means that the change can go in both directions. For example, we can melt butter (solid) to form a liquid (liquid butter) and we can freeze the liquid to get back the solid.
- When a substance changes its state, its mass remains the same.

MATERIALS

Large Ziploc bag/2-lb can with plastic lid
Small jar/small Ziploc bag
Crushed ice, about ½ kg per student
Metal spoon/wooden spoon
Chocolate milk or other milk mixture to fill each jar/small Ziploc bag 2/3 full
Newspapers to protect work surfaces
Sponge to clean the jar
Ice cubes/pieces of ice
Gloves or old towels to hold pan with
Butter/shortening
Candle wax
Matches
Spirit burners/hot plates/spirit lamps
Test tubes/metal bottle caps
Worksheet for students

STUDENT ACTIVITIES

Activity 1

- Students find the mass of a quantity of butter provided by the teacher, students record its mass. The teacher then heats the butter in a test tube or metal bottle cap until it just melts. The mass of the melted butter is then found before it solidifies. The activity is again repeated using candle wax. Students record all results on their work sheet.
- From results, students infer that (a) the change of state from solid to liquid is reversible (b) the mass of butter and candle remain the same when they change from solid to liquid.
- From observations previously made, students infer that the mass of water will remain the same when water changes from solid to liquid.

Activity 2

- Let students find the mass of a piece of ice/ice cube, and record observation. Ask students to then leave ice undisturbed until it melts, at which time the mass is again found. Students record results on their work sheet.
- Let students fill each jar/small Ziploc bag with milk mixture and close lid/zipper tightly. Pack salt and ice in the bottom of the milk can/large Ziploc bag. Put jar/small Ziploc bag into tin/large Ziploc bag. Pack salt and ice around and above jar/small Ziploc bag containing milk mixture. Cover can with lid/close zipper of large Ziploc bag. Using towel /gloves, shake can/Ziploc bag until the mixture freezes.
- Students then classify the changes noted as reversible or non-reversible.
- Ask students to state whether the ice cream contains the same materials they started with and to describe what has happened to it.

EXTENSION

Teacher can discuss with students the reasons for:

- i) adding salt to the ice
- ii) for shaking ice cream.

Let students write a poem about their favourite ice cream

ASSESSMENT

1. State what will happen if ice cream is left on counter.
2. Discuss storage of ice cream after it is produced
3. Provide other examples of freezing and melting to show that these changes are reversible.

DURATION: 2 Lessons

OBJECTIVES

Students should be able to:

1. Identify condensation and evaporation as changes of state.
2. Infer that condensation and evaporation are changes that can be reversed.

PROCESS SKILLS

Inferring, Observing, Communicating

MATERIALS

Wide plastic cups
Tall plastic cups
Boiling water
Ice cubes/pieces of ice
Magnifying glasses

CONTENT SUMMARY

- When liquid water is heated, water on the surface turns into water vapour and disappears into the atmosphere. This process is called **evaporation**.
- When water exists as a gas (water vapour) the particles are very far apart. However, when water vapour is cooled, the particles slow down and move closer together forming the liquid again. This process is called **condensation**.
- The changes from water to water vapour and vice versa are reversible changes.
- These changes occur in nature in the water cycle (*cross reference – Weather*).
- People use these processes also such as when we put our clothes to dry (evaporation).

STUDENT ACTIVITIES

Activity 1

- Boil some water, in a beaker, tin or pot. Let students observe what is happening. Put a glass with cold water on the desk, again ask students to observe and record what is happening.

Activity 2

- Pour hot water into a clear plastic cup up to two-thirds full. Quickly place a clear plastic cup over the cup. Place a piece of ice on the top of cup and wait 2 minutes. After this time, remove the ice and use a paper towel to dry off the water from the melted ice. Look closely at the top of the cup. Use a magnifier if one is available. Ask students what they notice.

- Ask students if they notice what happens when they remove a pot cover from a pot with boiling water. Some students will have observed water droplets. Ask students to explain what they think is happening in each activity.

- After students identify the processes taking place in the experiment they then infer if these processes are reversible or non-reversible.

ASSESSMENT

Ask students to define condensation and evaporation. Let them identify other situations where condensation and evaporation are involved. State the importance of these processes in everyday life.

DURATION: 4 Lessons

OBJECTIVES

Students should be able to:

1. Identify burning, rusting and decay as changes that are irreversible.
2. Identify examples of reversible and irreversible changes in everyday life.
3. Realise that people change materials all the time for different purposes.

PROCESS SKILLS

Observing, Communicating, Classifying, Inferring

CONTENT SUMMARY

- Burning is a process in which a substance reacts with oxygen and produces heat and light. The substance is changed to new materials. Everyday examples of burning – the burning of fuels, paper, garbage, leaves.
- Rusting is a process in which oxygen from the air reacts with iron, in the presence of water to form reddish-brown iron oxide, or rust. Rusting is the commonest form of corrosion. Objects made of iron such as nails, wrought iron furniture, car bodies rust when exposed to the air.
- Decay is a process whereby wood or other plant and animal material is disintegrated through the action of micro-organisms which breakdown the organic matter into simpler compounds. Plants, dead animals, and fruits decay.
- Burning, rusting and decay are examples of changes that cannot be reversed.
- People change materials all the time in daily life.

STUDENT ACTIVITIES

Activity 1

- Students weigh a sheet of paper; place the paper in a pie plate. Burn the paper. Note observations. Weigh the remains. Students then note the colour, odour, texture, thickness and mass of the remains and

compare with the original sheet of paper. (Note: New substances have been formed some of which have escaped into the air).

Activity 2

- Students place a painted nail and an unpainted nail in a clear container with water. Ask them to leave the nail undisturbed. Observe nail each day for a period of four days.

Activity 3

- Place a ball of wet steel wool in a test tube. Invert the test tube in a tray of water. The water should only be a few cm deep. Leave tube undisturbed for a few days; observe the tube each day for a period of one week. Record observations.

Activity 4

- Let students place a slice of bread, a piece of ripe fruit, a piece of cheese, a few spoons of cooked rice on individual paper plates. Cover each plate with clear plastic. Plates should be left undisturbed for about one week. Students should note changes each day.
- Let students identify the processes taking place in each experiment and then decide whether the processes investigated are reversible or non-reversible.

Activity 5

- Let students compile a booklet "Changes in matter". Students collect pictures, write descriptions, make drawings of changes they observe happening in their daily lives. Ask them to concentrate on changes that happen naturally and those that people make happen.

ASSESSMENT

- Each group can report the results of their experiments, giving reasons why each process investigated is reversible or irreversible.
- Students define: burning, rusting and decay.
- Students' booklets can be assessed using selected criteria.

UNIT : MATTER AND MATERIALS (GRADE 6)

DURATION: 3 Lessons

OBJECTIVES

Students should be able to:

1. Identify a production process, taking place in the home or industry.
2. Draw a diagram to show stages in the process.
3. Identify some of the changes taking place in the production process.
4. Appreciate that people use production processes to change materials to satisfy their needs.

PROCESS SKILLS

Observing, Communicating

MATERIALS

Video/pictures showing production processes in the home

Materials to demonstrate a production process, such as jam making.

CONTENT SUMMARY

- In a production process, people use technology to make goods and structures.
- Stages in the production process
 - Identify and select raw materials and equipment needed
 - Determine pre-processing preparation, e.g. washing
 - Prepare materials for processing e.g. chop, grind, sand, cut
 - Processing stage – heat, assembly, etc.
 - Sort, package, label, i.e. prepare for distribution
 - Determine storage conditions before and after distribution
 - Determine mode of transportation
 - Calculate cost of production
- Some processes in the production process, such as chopping and sanding, involve change of shape and size. Other changes are brought about by mixing, cooking, baking, reacting with chemicals.

SUGGESTED ACTIVITIES

Activity 1

- Teacher discusses with students what a production process is. He/she then asks students to list some of the activities taking place in the home. Students then identify one or more production processes in the home.
- He/she then shows a video/pictures to students of bread/jelly production. Let students identify and describe what is happening at each stage of the production process.
- Students draw a flow chart of the stages they have identified
- Students then identify changes at each stage of the production process, and say how these changes were brought about.

Activity 2

- Teacher demonstrates an actual production process e.g. jam-making, bread making. Students identify and list processes at each stage of production.
- Students discuss how people use production processes to change materials to get the products they want.

ASSESSMENT

1. Give students a project on a production process. Students list the ingredients they would need to make a simple production process, and then draw a flow chart of the stages they have identified.
2. From the flow chart drawn students then identify changes at each stage of the production process and explain how these changes have been brought about.

DURATION: 3 Lessons

OBJECTIVE

Students should be able to:

1. Appreciate that humans use production processes to change materials

PROCESS SKILLS

Observing, Communicating, Inferring

CONTENT SUMMARY

- Humans use a variety of production processes to change materials so that they can make more effective use of these materials.
- Production processes include:
 - Flour production:
 - Oil production:
 - Sugar production

STUDENT ACTIVITIES

Activity 1

Students are shown pictures/videos of a wide variety of production processes used by man; students identify the stages and processes

Demonstration of jam making

Demonstration of bread making

Activity 2

Field trip to an industry.

Students write down the stages in the production process seen at each industry

Activity 3

Students prepare a scrapbook of drawings/pictures showing the various stages for project work

ASSESSMENT

1. Students are divided into groups; Groups makes an oral presentations on a production processes they have selected.
2. Rubric is prepared by teacher and used to grade students on their attitude toward the group activity.
3. As their class project, students set up a mini-ice cream factory, using the apparatus from a previous science lesson. They then write down the stages in the ice cream production and calculate how much it would cost to produce the ice cream.

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